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CLEAN SET OF ALL PENDING CLAIMS RECEIVED

The clean set of all pending claims is attached.

TECH CENTER 2-70

CLAIMS

I claim:

1. A high efficiency switching amplifier for digitally processing electric power from a DC supply thereof to a loudspeaker, the switching amplifier comprising:

- a voltage source for supplying a DC voltage,
- a power modulator for transforming the DC voltage into modulated voltages,
- at least one transformer for changing the amplitudes of the modulated voltages,
- a synchronous demodulator for reconstructing the modulated voltages back to audio signal driving a load comprising a loudspeaker,
- a controller for receiving an audio signal to produce digital signals controlling the operation of the power modulator and the synchronous demodulator,

wherein the controller controlling the timing of digital signals to both the power modulator and the synchronous demodulator such that they change state substantially synchronously.

2. The switching amplifier of claim 1 wherein the transformer comprises a center-tapped secondary winding which has a first and a second terminals and a center-tapped terminal, and the synchronous demodulator comprises:

- a first and second switches for selectively connecting the first and second terminals of the transformer to a ground reference,
- four switches in a H-bridge configuration for selectively connecting the center-tapped terminal of the transformer to the ground reference through a load,

wherein the four switches of the H-bridge provide a bipolar signal to the load connected across the H-bridge.

3. The switching amplifier of claim 2 wherein the transformer comprises a primary winding and the power modulator comprises two switches for selectively connecting the primary winding to the DC voltage, forming a half-bridge-converter-type modulator.

4. The switching amplifier of claim 2 wherein the transformer comprises a primary winding and the power modulator comprises four switches in a H-bridge configuration for selectively connecting the primary winding to the DC voltage, forming a full-bridge-converter-type modulator.

5. The switching amplifier of claim 2 wherein the transformer comprises a center-tapped primary winding having two sides and the power modulator comprises two ground-referenced switches for selectively connecting alternatively each side of the center-tapped primary winding to ground reference, forming a push-pull-converter-type modulator.

6. The switching amplifier of claim 1 wherein the transformer comprises a center-tapped secondary winding which has a first and a second terminals and a center-tapped terminal, and the synchronous demodulator comprises:

- a first and second switches for selectively connecting the first and second terminals of the transformer to a common connection node,
- four switches in a H-bridge configuration for selectively connecting the common connection node to the center-tapped terminal through a load,

wherein the four switches of the H-bridge provide a bipolar signal to the load connected across the H-bridge.

7. The switching amplifier of claim 6 wherein the transformer comprises a primary winding and the power modulator comprises two switches for selectively connecting the primary winding to the DC voltage, forming a half-bridge-converter-type modulator.

8. The switching amplifier of claim 6 wherein the transformer comprises a primary winding and the power modulator comprises four switches in a H-bridge configuration for selectively connecting the primary winding to the DC voltage, forming a full-bridge-converter-type modulator.

9. The switching amplifier of claim 6 wherein the transformer comprises a center-tapped primary winding having two sides and the power modulator comprises two ground-referenced switches for selectively connecting alternatively each side of the center-tapped primary winding to ground reference, forming a push-pull-converter-type modulator.

10. The switching amplifier of claim 1 wherein the transformer comprises a multi-tapped winding which has a first, a second, a fourth, a fifth terminals and a center-tapped terminal, and wherein the synchronous demodulator comprises four switches in a H-bridge configuration for selectively connecting the first and second terminals of the transformer to a ground reference through a load, and wherein the power modulator comprises a push-pull-converter-type modulator.

11. The switching amplifier of claim 10 wherein an additional synchronous switch selectively connects the center-tapped terminal of the transformer to the DC voltage, and wherein the four switches of the synchronous demodulator are MOSFETs.

13. The switching amplifier of claim 11 wherein the MOSFETs are oriented toward the two common connection nodes of the H-bridge

14. The switching amplifier of claim 1 wherein the transformer comprises a center-tapped secondary winding which has a first and a second terminals and a center-tapped terminal, and the synchronous demodulator comprises:

- four switches in a H-bridge configuration for selectively connecting the first and second terminals of the center-tapped secondary winding of the transformer to a common connection node through a load,

- a fifth switch for selectively connecting the center-tapped terminals of the transformer to the common connection node,

wherein the four switches of the H-bridge provide a bipolar signal to the load connected across the H-bridge.

15. The switching amplifier of claim 14 wherein the transformer comprises a primary winding and the power modulator comprises two switches for selectively connecting the primary winding to the DC voltage, forming a half-bridge-converter-type modulator.

16. The switching amplifier of claim 14 wherein the transformer comprises a primary winding and the power modulator comprises four switches in a H-bridge configuration for selectively connecting the primary winding to the DC voltage, forming a full-bridge-converter-type modulator.

17. The switching amplifier of claim 14 wherein the transformer comprises a center-tapped primary winding having two sides and the power modulator comprises two ground-referenced switches for selectively connecting alternatively each side of the center-tapped primary winding to ground reference, forming a push-pull-converter-type modulator.

18. The switching amplifier of claim 1 wherein the power modulator comprises two switches operating one at a time and driving two transformers, each with a primary winding and a secondary winding, and the synchronous demodulator comprises four switches for selectively connecting the loudspeaker to the secondaries of the transformers one at a time.

19. The switching amplifier of claim 18 wherein the four switches of the synchronous demodulator are arranged to have a common connection node.

20. A method for reducing switching losses of a switching amplifier having a power modulator, a transformer, a synchronous demodulator, and a controller, the method comprising adaptively sending timing signals to the power modulator, and after predetermined delays, sending timing signals to the synchronous demodulator, wherein the predetermined delays cause the power modulator to operate in zero current switching.